PB-239 642

LAKE WISSOTA, CHIPPEWA COUNTY, WISCONSIN

Pacific Northwest Environmental Research Laboratory

Prepared for:

National Environmental Research Center
Wisconsin National Guard
Wisconsin Department of Natural Resources

October 1974

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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REPORT
ON
LAKE WISSOTA
CHIPPEWA COUNTY
WISCONSIN

EPA REGION V

WORKING PAPER No. 59

WITH THE COOPERATION OF THE

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

AND THE

WISCONSIN NATIONAL GUARD

OCTOBER, 1974

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Wisconsin Department of Natural Resources for professional involvement and to the Wisconsin National Guard for conduct of the tributary sampling phase of the Survey.

Francis H. Schraufnagel, Acting Assistant Director, and Joseph R. Ball of the Bureau of Water Quality, and Donald R. Winter, Lake Rehabilitation Program, provided invaluable lake documentation and counsel during the Survey. Central Office and District Office personnel of the Department of Natural Resources reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper series.

Major General James J. Lison, Jr., the Adjutant General of Wisconsin, and Project Officer CW-4 Donald D. Erickson, who directed the volunteer efforts of the Wisconsin National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

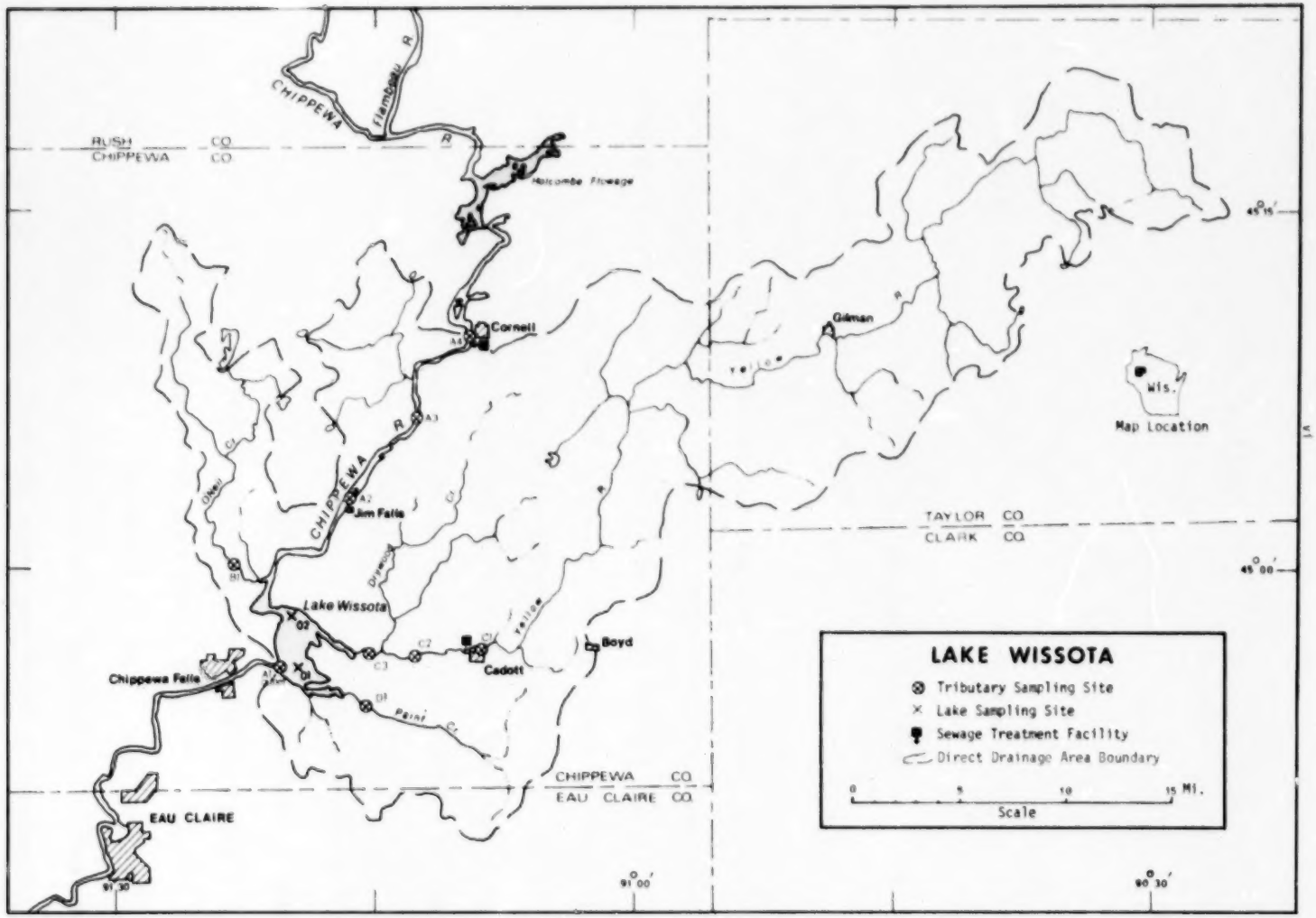
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF WISCONSIN

LAKE NAME	COUNTY
Altoona	Eau Claire
Beaver Dam	Barron
Beaver Dam	Dodge
Big Eau Pleine	Marathon
Browns	Racine
Butte des Morts	Winnebago
Butternut	Price, Ashland
Castle Rock Flowage	Juneau
Como	Walworth
Crystal	Vilas
Delavan	Walworth
Eau Claire	Eau Claire
Elk	Price
Geneva	Walworth
Grand	Green Lake
Green	Green Lake
Kegonsa	Dane
Koshkonong	Jefferson, Rock, Dane
Lac La Belle	Waukesha
Long	Price
Middle	Walworth
Nagawicka	Waukesha
Oconomowoc	Waukesha
Okauchee	Waukesha
Petenwell Flowage	Juneau
Pewaukee	Waukesha
Pigeon	Waupaca
Pine	Waukesha
Poygan	Winnebago, Waushara
Rock	Jefferson
Rome Pond	Jefferson, Waukesha
Round	Waupaca
Shawano	Shawano

LAKE NAME	COUNTY
Sinnissippi	Dodge
Swan	Columbia
Tainter	Dunn
Tichigan	Racine
Townline	Oneida
Trout	Vilas
Wapogassett	Polk
Wausau	Marathon
Willow	Oneida
Winnebago	Winnebago, Fond Du Lac, Calumet
Wisconsin	Columbia
Wissota	Chippewa
Yellow	Burnett


RUSH CO
CHIPPEWA CO
TAYLOR CO
CLARK CO
CHIPPEWA CO
EAU CLAIRE CO
CHIPPEWA R
Flambeau R
Holcombe Flowage
Cornell
Gilman
Jim Falls
Lake Wissota
Chippewa Falls
Cadott
Boyd
EAU CLAIRE
Wis.
Map Location
45°15'
45°00'
91°30'
91°00'
90°30'
LAKE WISSOTA
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Direct Drainage Area Boundary
0 5 10 15 Mi.
Scale

LAKE WISSOTA

STORET NO. 5556

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate Lake Wissota is eutrophic.

B. Rate-Limiting Nutrient:

Results of the algal assay and the lake data indicate that Lake Wissota is nitrogen limited.

C. Nutrient Controllability:

1. Point sources--During the sampling year, Lake Wissota received a total phosphorus load at a rate over three times that proposed by Vollenweider (in press) as "dangerous"; i.e., a eutrophic rate (see page 13). However, it is estimated that the communities of Cornell and Cadott contributed only about two percent of the load to the lake, and it is concluded that phosphorus removal at the two point sources would have little effect on the trophic condition of Lake Wissota.

2. Non-point sources (see page 13)--The total phosphorus exports of the Yellow River and O'Neil Creek were somewhat higher than the exports of Wisconsin streams studied elsewhere, but the export of Paint Creek was about the same as that of unimpacted Lamb Creek elsewhere in the Chippewa River Basin (see Working Paper No. 51, "Report on Tainter Lake"). However, the estimated export of the Chippewa River was among the lowest of the phosphorus exports of the Wisconsin streams studied.

II. INTRODUCTION

Lake Wissota is an impoundment of the Chippewa River near Chippewa Falls. The dam was constructed in 1917 by the Northern States Power Company (Martin and Hanson, 1966). Commercially, the lake is used for the generation of electricity.

Recreational uses of the lake include swimming, boating, and fishing. Game fish present include muskellunge, northern pike, walleyes, large-mouth bass, and panfish. Much of the shoreline is privately owned, but public access is provided and a number of resorts offer boats and services (Sather and Threinen, 1963).

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry*:

1. Surface area: 5,429 acres.
2. Mean depth: 28.9 feet.
3. Maximum depth: 72 feet.
4. Volume: 157,044 acre/feet.
5. Mean hydraulic retention time: 17 days.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area†	Mean flow†
Chippewa River	4,920.0 mi^2	4,228.8 cfs
O'Neil Creek	67.1 mi^2	45.1 cfs
Yellow River	436.0 mi^2	341.2 cfs
Paint Creek	55.3 mi^2	35.4 cfs
Minor tributaries & immediate drainage -	63.1 mi^2	48.6 cfs
Totals	5,541.5 mi^2	4,699.1 cfs

2. Outlet -

Chippewa River	5,550.0 $mi^{2\dagger}$	4,699.1 cfs

C. Precipitation†††:

1. Year of sampling: 40.3 inches.
2. Mean annual: 31.1 inches.

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* Dept. of Natural Resources 1940 lake survey map; recalculated in 1973.
† Drainage areas are accurate within ±0.5%; mean daily flows are accurate within ±40%; mean monthly flows are accurate within ±35%; and normalized monthly flows are accurate within ±35%.
†† Includes area of lake.
††† See Working Paper No. 1, "Survey Methods".

IV. LAKE WATER QUALITY SUMMARY

Lake Wissota was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two stations on the lake and from a number of depths at each station (see map, page vi). During each visit, a single depth-integrated (15 feet or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 54 feet at station 1 and 15 feet at station 2.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (11/05/72)		
Temperature (Cent.)	4.8	5.0	5.0	5.2
Dissolved oxygen (mg/l)	11.2	11.2	11.2	11.3
Conductivity (μmhos)	82	86	85	90
pH (units)	7.2	7.3	7.3	7.4
Alkalinity (mg/l)	25	28	28	29
Total P (mg/l)	0.039	0.043	0.043	0.047
Dissolved P (mg/l)	0.024	0.026	0.025	0.030
NO_2 + NO_3 (mg/l)	0.150	0.160	0.160	0.170
Ammonia (mg/l)	0.070	0.087	0.080	0.100
		ALL VALUES		
Secchi disc (inches)	24	39	42	48

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
06/26/72	1. Melosira	1,228
	2. Chroococcus	226
	3. Merismopedia	151
	4. Anabaena	113
	5. Flagellates	75
	Other genera	287
	Total	2,080
08/26/72	1. Anabaena	135
	2. Flagellates	89
	3. Dinobryon	72
	4. Melosira	34
	5. Navicula	29
	Other genera	109
	Total	468
11/05/72	1. Scenedesmus	1,508
	2. Flagellates	1,508
	3. Dinobryon	1,206
	4. Pediastrum	528
	5. Anabaena	302
	Other genera	1,229
	Total	6,281

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
06/26/72	01	9.7
	02	13.3
08/26/72	01	2.5
	02	1.1
11/05/72	01	2.0
	02	1.5

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.020	0.182	3.8
0.006 P	0.026	0.182	3.8
0.012 P	0.032	0.182	3.7
0.024 P	0.044	0.182	3.7
0.060 P	0.080	0.182	3.9
0.060 P + 10.0 N	0.080	10.182	41.4
10.0 N	0.020	10.182	11.0

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the productivity of Lake Wissota was somewhat high at the time the sample was collected but not particularly noteworthy when compared to the other 45 Wisconsin lakes studied (48% had higher control yields). Also, the lack of significant change in yields with increased levels of orthophosphorus, until nitrogen was also added, shows that the lake

was nitrogen limited when sampled. Note that the addition of only nitrogen resulted in a yield higher than the control.

The lake data indicate nitrogen limitation at the other sampling times as well. The nitrogen/phosphorus ratios were 6/1 and 7/1 for the June and August samples respectively (i.e., nitrogen limitation would be expected).

D. Trophic Condition:

Survey data indicate Lake Wissota is eutrophic. Survey limnologists noted an algal bloom in progress during the June sampling; reportedly, such blooms are not infrequent, and rooted aquatic vegetation is said to occur over much of the littoral zone of the lake (Anonymous, 1972).

Of the 46 Wisconsin lakes studied, 29 had more mean total phosphorus, 24 had more mean dissolved phosphorus, and 29 had more mean inorganic nitrogen. However, the short retention time in Lake Wissota is probably the reason for moderate nutrient concentrations in spite of the high nutrient loading rates of 79 lbs per surface acre per year of total phosphorus and 2,276 lbs/acre/yr of total nitrogen.

V. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the Wisconsin National Guard collected a monthly near-surface grab sample from each of the tributary sites indicated on the map (page vi), except for the high runoff months of April and May when two samples were collected. Sampling was begun in September, 1972, and was completed in August, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Wisconsin District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated by using the mean concentrations in Paint Creek at station D-1 and the mean ZZ flow.

The operator of the Cadott wastewater treatment plant provided monthly effluent samples and corresponding flow data; however, the City of Cornell declined to participate in the Survey, and nutrient loads from that source were estimated at 2.5 lbs P and 7.5 lbs N/capita/year.

In the following loading tables, the nutrient loads attributed to the Chippewa River are those measured at station A-2 minus the estimated

* See Working Paper No. 1.

Cornell loads; the loads given for the Yellow River are those measured at station C-3 minus the measured Cadott loads.

A. Waste Sources:

1. Known municipal -

Name	Pop. Served*	Treatment	Mean Flow (mgd)	Receiving Water
Cornell	1,616	Primary	0.110**	Chippewa River
Cadott	977	Act. Sludge	0.150	Yellow River

2. Known industrial** -

Name	Product	Treatment	Mean Flow (mgd)	Receiving Water
Falls Dairy Co.	cheese	land disposal†	2.150	Chippewa River

* 1970 Census.
** McKersie, et al., 1971.
† Reportedly, the treatment system failed in mid-1973; plans were approved for expanded system in October, 1973 (Schraufnagel, 1974). Survey data do not indicate any impact during the sampling year.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Chippewa River	334,110	77.8
O'Neil Creek	9,370	2.2
Yellow River	62,810	14.6
Paint Creek	5,990	1.4
b. Minor tributaries & immediate drainage (non-point load) -	8,130	1.9
c. Municipal STP's -		
Cornell	4,040	1.0
Cadott	3,590	0.8
d. Septic tanks* -	450	0.1
e. Industrial -		
Falls Dairy Company	?	-
f. Direct precipitation** -	980	0.2
Total	429,470	100.0

2. Outputs -

Lake outlet - Chippewa River 363,660

3. Net annual P accumulation - 65,810 pounds

* Six resorts, 625 dwellings, 2 camps, and 5 parks on lakeshore (Sather and Threinen, 1963); see Working Paper No. 1.
** See Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Chippewa River	10,808,590	87.5
O'Neil Creek	194,840	1.6
Yellow River	947,770	7.7
Paint Creek	130,660	1.1
b. Minor tributaries & immediate drainage (non-point load) -	179,100	1.4
c. Municipal STP's -		
Cornell	12,120	<0.1
Cadott	10,200	<0.1
d. Septic tanks* -	16,800	0.1
e. Industrial -		
Falls Dairy Company	?	-
f. Direct precipitation** -	60,690	0.5
Total	12,357,700	100.0

2. Outputs -

Lake outlet - Chippewa River 9,054,710

3. Net annual N accumulation - 3,302,990 pounds

* Six resorts, 625 dwellings, 2 camps, and 5 parks on lakeshore (Sather and Threinen, 1963); see Working Paper No. 1.
** See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs P/mi^2/yr	lbs N/mi^2/yr
Chippewa River	68	2,197
Yellow River	144	2,174
O'Neil Creek	140	2.904
Paint Creek	108	2,363

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving waters would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Units	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
lbs/acre/yr	79.1	12.1	2,276.2	608.4
grams/m^2/yr	8.87	1.36	255.1	68.2

Vollenweider loading rates for phosphorus ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Lake Wissota:

"Dangerous" (eutrophic rate)	2.60
"Permissible" (oligotrophic rate)	1.30

VI. LITERATURE REVIEWED

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VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR WISCONSIN 9/30/74

LAKE CODE 5556 LAKE WISSOTA

TOTAL DRAINAGE AREA OF LAKE 5550.00

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
5556A1	5550.00	2100.7	2009.3	4658.0	10960.0	8676.7	7124.0	4018.7	2922.7	4018.7	3836.0	3653.3	2374.7	4699.0
5556A2	4920.00	2000.00	1900.00	4500.00	9000.00	7500.00	6200.00	3700.00	2800.00	3900.00	3600.00	3400.00	2200.00	4228.77
5556B1	67.10	26.00	29.00	99.00	94.00	46.00	53.00	35.00	28.00	38.00	32.00	32.00	29.00	45.12
5556C3	436.00	52.00	37.00	420.00	1300.00	620.00	610.00	260.00	135.00	190.00	190.00	200.00	81.00	341.19
5556D1	55.30	20.00	22.00	80.00	77.00	36.00	42.00	27.00	21.00	29.00	24.00	24.00	22.00	35.36
5556ZZ	71.60	29.00	32.00	100.00	100.00	49.00	57.00	38.00	32.00	42.00	36.00	36.00	32.00	48.61

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 5550.00
SUM OF SUB-DRAINAGE AREAS = 5549.99
TOTAL FLOW IN = 56343.00
TOTAL FLOW OUT = 56352.79

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
5556A1	9	72	6000.00	23	5400.00				
	10	72	8500.00	27	7000.00				
	11	72	9300.00	24	4800.00				
	12	72	4000.00	26	4000.00				
	1	73	4900.00						
	2	73	4400.00	23	4840.00				
	3	73	16400.00	23	9530.00				
	4	73	9100.00	7	7330.00	23	9360.00		
	5	73	17600.00	11	23400.00	24	7580.00		
	6	73	7070.00	21	3830.00				
	7	73	2780.00	26	3410.00				
	8	73	3630.00	23	4320.00				
5556A2	9	72	6000.00	23	5200.00				
	10	72	7600.00	27	6400.00				
	11	72	8600.00	24	4200.00				
	12	72	3900.00	26	3900.00				
	1	73	4500.00						
	2	73	3600.00	23	3420.00				
	3	73	14900.00	23	8720.00				
	4	73	7610.00	7	6330.00	23	8180.00		
	5	73	14800.00	11	20300.00	24	5750.00		
	6	73	6340.00	21	3980.00				
	7	73	2470.00	26	3520.00				
	8	73	3260.00	23	3900.00				

TRIBUTARY FLOW INFORMATION FOR WISCONSIN 9/30/74

LAKE CODE 5556 LAKE MISSOTA

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
555681	9	72	45.00	23	43.00				
	10	72	53.00	27	47.00				
	11	72	55.00	24	44.00				
	12	72	39.00	26	40.00				
	1	73	38.00						
	2	73	38.00	23	40.00				
	3	73	260.00	23	120.00				
	4	73	89.00	7	70.00	23	83.00		
	5	73	120.00	11	170.00	24	56.00		
	6	73	29.00	21	18.00				
	7	73	39.00	26	48.00				
	8	73	34.00	23	37.00				
5556C3	9	72	720.00	23	490.00				
	10	72	680.00	27	210.00				
	11	72	700.00	24	200.00				
	12	72	130.00	26	95.00				
	1	73	250.00						
	2	73	100.00	23	78.00				
	3	73	1500.00	23	760.00				
	4	73	620.00	7	490.00	23	580.00		
	5	73	990.00	11	1400.00	24	450.00		
	6	73	310.00	21	190.00				
	7	73	60.00	26	72.00				
	8	73	72.00	23	72.00				
555601	9	72	37.00	23	35.00				
	10	72	43.00	27	39.00				
	11	72	46.00	24	36.00				
	12	72	32.00	26	33.00				
	1	73	17.00						
	2	73	31.00	23	36.00				
	3	73	220.00	23	97.00				
	4	73	72.00	7	56.00	23	67.00		
	5	73	98.00	11	140.00	24	45.00		
	6	73	23.00	21	14.00				
	7	73	32.00	26	40.00				
	8	73	27.00	23	30.00				
5556ZZ	9	72	50.00	23	34.00				
	10	72	47.00	27	14.00				
	11	72	49.00	24	14.00				
	12	72	9.00	26	6.60				
	1	73	18.00						
	2	73	7.00	23	5.30				
	3	73	280.00	23	120.00				
	4	73	96.00	7	75.00	23	89.00		
	5	73	130.00	11	180.00	24	61.00		
	6	73	32.00	21	20.00				
	7	73	3.80	26	4.50				
	8	73	4.40	23	4.30				

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/09/30

555601
44 56 24.0 091 19 18.0
LAKE WISSOTA
55 WISCONSIN

11EPALES 2111202
3 0058 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/26	13 30	0000	22.0	9.4	48	125	8.50	32	0.070	0.060	0.034	0.028
	13 30	0020	20.0	9.4		100	7.60	32	0.120	0.090	0.033	0.029
72/08/26	08 30	0000			48	88	7.10	92	0.060	0.120	0.031	0.013
	08 30	0004	20.3	7.5		88	7.10	31	0.180	0.110	0.050	0.043
	08 30	0015	20.4	6.8		85	7.10	27	0.190	0.100	0.042	0.030
	08 30	0025	20.2	7.0		85	7.10	29	0.180	0.120	0.042	0.031
	08 30	0035	20.1	6.8		83	7.10	27	0.180	0.120	0.051	0.033
	08 30	0042	20.1	6.9		80	7.00	28	0.170	0.110	0.047	0.033
	08 30	0052	19.8	6.7		80	7.00	25	0.180	0.150	0.056	0.032
72/11/05	14 10	0000			24	88	7.20	28	0.170	0.100	0.042	0.024
	14 10	0004	5.2	11.2		85	7.20	28	0.160	0.080	0.043	0.030
	14 10	0015	5.1	11.2		85	7.20	28	0.160	0.080	0.047	0.026
	14 10	0025	5.1	11.2		85	7.40	28	0.150	0.080	0.043	0.025
	14 10	0040	4.9	11.2		85	7.40	25	0.160	0.090	0.044	0.024
	14 10	0054	4.8	11.2		82	7.30	26	0.160	0.100	0.044	0.028

61

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/26	13 30	0000	9.7J
72/08/26	08 30	0000	2.5J
72/11/05	14 10	0000	2.0J

J* VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 74/09/30

555602
44 58 18.0 091 19 42.0
LAKE WISSOTA
55 WISCONSIN

11EPALES 2111202
3 0019 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/26	13 50	0000	20.3	9.0	48	110	8.00	35	0.090	0.060	0.032	0.026
	13 50	0015	19.7	9.3		110	7.50	35	0.110	0.090	0.032	0.028
72/08/26	11 05	0000			36	80	7.00	91	0.070	0.100	0.061	0.017
	11 05	0004	19.8	6.0		80	7.00	92	0.060	0.180	0.150	0.059
	11 05	0013	19.5	7.0		80	7.00	94	0.060	0.200	0.140	0.074
72/11/05	14 30	0000			28	90	7.30	27	0.170	0.100	0.039	0.025
	14 30	0004	5.0	11.2		85	7.30	29	0.150	0.070	0.040	0.024
	14 30	0013	5.0	11.3		85	7.30	29	0.160	0.080	0.043	0.024

20

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/26	13 50	0000	13.3J
72/08/26	11 05	0000	1.1J
72/11/05	14 30	0000	1.5J

J= VALUE KNOWN TO BE IN ERROR

APPENDIX C

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 74/10/02

5556A1 LS5556A1
44 56 30.0 091 20 30.0
CHIPPEWA RIVER
55 15 CHIPPEWA FALL
0/LAKE WISSOTA
DAM 2.5 MI E OF CHIPPEWA FALLS
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	14 25		0.030	1.850	0.076	0.026	0.075
72/10/27	15 04			1.400			
72/11/24	13 50		0.147	0.630	0.027	0.019	0.046
72/12/26	10 25		0.220	0.660	0.028	0.016	0.034
73/01/27	13 40		0.210	0.540	0.054	0.019	0.030
73/02/23	12 00		0.252	0.580	0.042	0.017	0.040
73/03/23	12 40		0.189	0.670	0.102	0.019	
73/04/07	13 06		0.168	0.550	0.050	0.017	0.035
73/04/23	16 30		0.120	0.700	0.028	0.017	0.040
73/05/11	15 40		0.095	0.760	0.037	0.015	0.040
73/05/24	09 10		0.084	1.800	0.088	0.013	0.035
73/06/21	13 30		0.063	0.750	0.115	0.032	0.050
73/07/26	14 00		0.080	0.650	0.052	0.013	0.030
73/09/23	13 30		0.058	0.710	0.085	0.017	0.040

STORET RETRIEVAL DATE 74/10/02

5556A2 LS5556A2
45 03 30.0 091 16 30.0
CHIPPEWA RIVER
55 15 BLOOMER
T/LAKE WISSOTA
CO RD BRDG .75 MI BELO JIM FALLS-DAM
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	16 45		0.519	1.250	0.228	0.029	0.063
72/10/27	10 03		0.096	0.700	0.050	0.019	0.050
72/11/24	09 10		0.120	4.100	0.066	0.016	0.042
72/12/26	14 25		0.160	1.540	0.105	0.016	0.037
73/01/27	14 40		0.230	0.500	0.048	0.016	0.030
73/02/23	12 25		0.231	0.520	0.017	0.017	0.040
73/03/23	14 25		0.138	0.550	0.044	0.012	
73/04/07	13 40		0.099	0.540	0.020	0.011	0.030
73/04/23	14 23		0.048	0.520	0.005K	0.009	0.030
73/05/11	14 35		0.065	0.600	0.033	0.013	0.040
73/05/24	13 30		0.054	0.960	0.042	0.013	0.040
73/06/21	13 30		0.061	1.200	0.063	0.018	0.040
73/07/26	16 25		0.026	2.600	0.105	0.010	0.045
73/09/23	16 20		0.017	0.480	0.028		0.025

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/10/02

5556A3 L55556A3
45 06 30.0 091 12 30.0
CHIPPEWA RIVER
55 15 CORNELL
T/LAKE MISSOTA
CO RD BRDG N OF CORBAN BELO CORNELL STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	16	30	0.815	2.500	0.420	0.033	0.072
72/10/27	09	50	0.094	0.750	0.058	0.018	0.045
72/11/24	08	55	0.110	1.150	0.036	0.014	0.036
72/12/26	13	25	0.169	1.050	0.064	0.017	0.038
73/01/27	11	00	0.190	0.875	0.075	0.018	0.035
73/02/23	12	40	0.210	0.980	0.072	0.019	0.045
73/03/23	14	10	0.132	0.520	0.042	0.011	
73/04/07	13	50	0.086	0.520	0.019	0.010	0.030
73/04/23	14	32	0.046	0.520	0.005K	0.009	0.030
73/05/11	14	25	0.052	0.890	0.032	0.013	0.040
73/05/24	14	10	0.089	1.000	0.046	0.011	0.040
73/06/21	13	45	0.066	0.840	0.070	0.019	0.045
73/07/26	16	10	0.020	0.780	0.021	0.007	0.040
73/08/23	16	05	0.050	1.200	0.061	0.023	0.040

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 74/10/02

5556A4 LS5556A4
45 10 00.0 091 09 30.0
CHIPPEWA RIVER
55 15 CORNELL
T/LAKE WISSOTA
DAM OUTLET IN CORNELL ABOV STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	16 15		0.725	1.100	0.175	0.032	0.065
72/10/27	09 30		0.105	0.762	0.189	0.018	0.050
72/11/24	08 40		0.110	0.620	0.023	0.013	0.034
72/12/26	12 15		0.147	0.980	0.056	0.011	0.031
73/01/27	11 20		0.189	0.730	0.056	0.017	0.030
73/02/23	12 55		0.200	0.520	0.044	0.016	0.035
73/03/23	13 55		0.132	0.600	0.044	0.010	0.015
73/04/07			0.084	0.500	0.021	0.009	0.025
73/04/23	14 30		0.046	0.540	0.005K	0.008	0.030
73/05/11	14 15		0.044	1.200	0.075	0.012	0.045
73/05/24	14 30		0.066	0.860	0.052	0.014	0.040
73/06/21	16 00		0.054	0.800	0.048	0.018	0.040
73/07/26	15 50		0.011	0.780	0.015	0.012	0.047
73/08/23	15 45		0.035	1.000	0.035	0.021	0.045

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 74/10/02

555681 LS5556R1
45 00 30.0 091 23 30.0
ONEILL CREEK
55 15 BLOOMER
T/LAKE WISSOTA
US 53 XING 4 MI N OF CHIPPEWA FALLS
11EPALFS 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	17 30		0.175	0.600	0.255	0.083	0.105
72/10/27	10 15		1.020	0.780	0.042	0.042	0.095
72/11/24	09 30		1.540	0.840	0.011	0.048	0.081
72/12/26	14 45		2.060	0.710	0.058	0.056	0.105
73/01/27	10 20		1.800	0.970	0.093	0.058	0.110
73/02/23	13 00		2.000	1.800	0.085	0.058	0.095
73/03/23	14 45		1.000	0.700	0.054	0.036	
73/04/07	13 05		1.280	0.595	0.014	0.044	0.085
73/04/23	14 05		0.990	0.750	0.009	0.052	0.085
73/05/11	13 40		0.440	0.780	0.025	0.044	0.090
73/05/24	13 15		0.550	0.890	0.035	0.058	0.125
73/06/21	12 45		1.620	0.660	0.044	0.096	0.157
73/07/26	16 45		1.460	1.260	0.063	0.082	0.125
73/09/23	16 50		1.480	1.950	0.063	0.074	0.100

STORET RETRIEVAL DATE 74/10/02

5556C1 L55556C1
44 57 30.0 091 09 00.0
YELLOW RIVER
55 15 CADOTT
1/LAKE WISSOTA
ST HWY 27 BRDG N OF CADOTT ABOVE STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	15 45		0.110	1.950	0.161	0.042	0.148
72/10/27	14 30		0.115	2.100	0.410	0.038	0.085
72/11/24	14 25		0.240	0.840	0.022	0.031	0.062
72/12/26	12 20		0.430	0.930	0.105	0.042	0.085
73/01/27	12 00		0.260	0.980	0.140	0.046	0.080
73/02/23	13 15		0.460	1.320	0.120	0.063	0.095
73/03/23	13 25		0.115	0.690	0.046	0.022	
73/04/07	14 00		0.094	0.600	0.017	0.023	0.050
73/04/23	15 20		0.067	0.660	0.005K	0.021	0.050
73/05/11	15 00		0.049	0.690	0.025	0.025	0.060
73/05/24	09 25		0.093	0.900	0.033	0.029	0.055
73/06/21	15 00		0.084	1.520	0.110	0.044	0.070
73/07/26	15 25		0.020	0.940	0.075	0.033	0.085
73/08/23	14 50		0.016	0.600	0.036	0.017	0.040

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 74/10/02

5556C2 LS5556C2
44 56 30.0 091 12 30.0
YELLOW RIVER
55 IS CADOTT
I/LAKE WISSOTA
CO HWY X 9MDG W OF CADOTT BELO STP
11FPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/21	15 30		0.080	2.200	0.142	0.034	0.160
72/10/27	14 18		0.120	1.100	0.105	0.042	0.090
72/11/24	14 35		0.235	1.150	0.044	0.050	0.080
72/12/26	11 25		0.450	1.400	0.135	0.084	0.131
73/01/27	12 15		0.260	1.600	0.154	0.052	0.090
73/02/23	12 45		0.490	0.770	0.126	0.074	0.104
73/03/23	13 05		0.130	0.560	0.050	0.027	
73/04/07	13 28		0.160	0.740	0.030	0.028	0.055
73/04/23	15 40		0.065	0.705	0.011	0.026	0.065
73/05/11	15 15		0.039	0.720	0.034	0.029	0.065
73/05/24	08 55		0.089	2.200	0.092	0.032	0.065
73/06/21	15 00		0.120	0.750	0.024	0.050	0.105
73/07/26	14 50		0.083	1.300	0.046	0.062	0.105
73/08/21	14 30		0.105	0.660	0.058	0.160	0.190

STORET RETRIEVAL DATE 74/10/02

SS56C3 LS5556C3
44 56 30.0 091 15 00.0
YELLOW RIVER
55 15 CHIPPEWA FALL
1/LAKE WISSOTA
UPSTRM OF CO HWY K BWDG ENECHIPEWA FALLS
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	15 00		0.827	1.550	0.191	0.099	0.160
72/10/27	14 00		0.140	1.100	0.240	0.046	0.095
72/11/24	14 50		0.300	0.840	0.031	0.063	0.110
72/12/26	11 05		0.660	0.880	0.126	0.092	0.147
73/01/27	13 15		0.315	1.000	0.140	0.054	0.090
73/02/23	12 30		0.700	1.200	0.132	0.083	0.130
73/04/07	13 45		0.560	0.660	0.018	0.029	0.050
73/04/23	16 05		0.080	0.880	0.012	0.026	0.060
73/05/11	15 15		0.049	1.400	0.088	0.049	0.090
73/05/24	08 30		0.132	0.850	0.028	0.048	0.085
73/06/21	09 43		0.069	0.880	0.042	0.052	0.085
73/07/26	14 15		0.015	2.310	0.016	0.026	0.155
73/08/23	14 05		0.132	1.470	0.056	0.036	0.085

STORET RETRIEVAL DATE 74/10/02

555601 LS555601
44 55 00.0 091 15 30.0
PAINT CREEK
55 15 CHIPPEWA
T/LAKE WISSOTA
CO HWY K BRDG ESE OF CHIPPEWA FALLS
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	15 15		0.340	1.400	0.265	0.100	0.146
72/10/27	14 45		0.510	0.645	0.030	0.037	0.080
72/11/24	14 10		1.160	0.370	0.037	0.048	0.072
72/12/26	10 45		1.340	0.460	0.093	0.052	0.088
73/01/27	12 40		0.960	0.710	0.090	0.042	0.065
73/02/23	12 15		1.500	2.700	0.110	0.050	0.065
73/03/23	12 55		0.830	0.480	0.050	0.028	
73/04/07	14 20		0.570	0.540	0.023	0.032	0.050
73/04/23	16 00		0.580	0.740	0.007	0.042	0.075
73/05/11	13 40		0.170	0.790	0.026	0.036	0.085
73/05/24	08 40		0.154	1.050	0.031	0.039	0.090
73/06/21	14 30		1.040	1.600	0.087	0.088	0.125
73/07/26	14 30		1.280	2.350	0.100	0.048	0.085
73/08/23	13 45		1.460	0.480	0.052	0.058	0.085

STORET RETRIEVAL DATE 74/09/30

555651 AS555651 P000977
44 57 00.0 091 09 30.0
CITY OF CADOTT
SS 1S CADOTT
T/LAKE WISSOTA
Y/ELLOW RIVER
11EPALES 2141204
4 0000 FEET DEPTH

Reproduced from best available copy.

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/03/06	09 00		0.010K	19.800	6.450	6.720	7.900	0.160	0.135
	09 30		0.075	23.100	9.200	8.500	9.300	0.160	0.135
	10 00		0.020	21.000	9.700	7.300	8.095	0.160	0.135
	11 00		0.010K	21.000	8.600	7.100	7.800	0.160	0.135
	12 00		0.010K	22.000	8.400	6.800	7.100	0.160	0.135
	13 00		0.010K	22.500	8.100	6.600	7.300	0.160	0.135
	14 00		0.010K	25.200	8.900	6.720	7.400	0.160	0.135
	15 00		0.010K	27.300	9.100	7.140	8.000	0.160	0.135
	16 00		0.010K	23.000	10.000	7.400	8.100	0.160	0.135
	17 00		0.010K	35.000	9.800	7.800	8.500	0.160	0.135
	18 00		0.010K	35.000	10.400	8.800	11.000	0.160	0.135
	19 00		0.010K	26.200	10.900	9.300	9.500	0.160	0.135
	20 00		0.010K	24.000	10.800	9.400	9.800	0.160	0.135
73/04/05	08 30								
CP(T)-			0.053	12.000	2.500	2.700	3.600	0.212	0.250
73/04/05	20 00								
73/05/24	08 00								
CP(T)-			0.210	11.000	0.316	2.060	2.500	0.254	0.300
73/05/29	20 00								
73/06/22	08 00								
CP(T)-			0.037	15.000	4.800	10.500	11.500	0.169	0.210
73/06/22	20 00								
73/07/24	08 00								
CP(T)-			0.067	19.000	6.300	5.031	6.000	0.124	0.138
73/07/24	20 00								
73/08/30	08 00								
CP(T)-				23.400	7.000	1.100	1.370	0.148	0.135
73/08/30	20 00								
73/09/23	08 00								
CP(T)-			0.110	14.000	7.400	4.900	5.300	0.150	0.125
73/09/23	20 00								
73/10/31	08 00								
CP(T)-			0.130	21.500	7.800	13.000	17.000	0.123	0.125
73/10/31	20 00								
73/11/29	08 00								
CP(T)-			0.170	33.500	11.000	12.000	14.500	0.116	0.120
73/11/29	20 00								

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/09/30

555651 AS555651 P000977
44 57 30.0 091 09 30.0
CITY OF CADOTT
55 15 CADOTT
T/LAKE WISSOTA
YELLOW RIVER
11FPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/01/25	08 00								
CP(T)-			0.040	22.000	9.660	7.220	8.700	0.109	0.105
74/01/25	20 00								
74/02/22	08 00								
CP(T)-			0.080	22.000	11.900	7.100	8.150	0.110	0.108
74/02/22	20 00								
74/03/29	08 00								
CP(T)-			0.040	16.000	5.100	2.700	4.100	0.130	0.125
74/03/29	20 00								
74/04/29	09 00								
CP(T)-			0.120	15.000	4.000	2.900	3.900	0.160	0.225
74/04/29	20 00								